


Linking Teaching and Learning A Longitudinal Approach to the Assessment of Information Literacy

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attending the Environmental Sciences degree course. Students' learning is assessed and measured all along the development of the programme in a longitudinal way and all the learning activities are designed and tailored according to what emerges from the assessment stages.

Different assessment methods are adopted: questionnaire, pre/post test, task analysis, citation analysis and interviews. The overall approach of this project is grounded on the principles of evidence-based practice, with a particular attention to the collection of valid and applicable data and a continuous systematic reference to LIS literature. Some preliminary results, related to the first longitudinal cycle (2004-2007) are presented. Students improve, along their study path, in terms of knowledge and skills. Also their attitude towards information develop in direction of increasing awareness and independence.¹

Evidence-based practice, Information Literacy and assessment of student learning

Evidence-based librarianship, according to one of the most well-known definition, seeks to *Improve the profession of librarianship by asking questions, finding, critically appraising and incorporating research evidence from library science into daily practice (Eldredge, 2002).*

Another definition (McKibbin, 1996, quoted by Booth & Brice, 2004), put the accent on the *collection interpretation and integration of valid, important and applicable user-reported, librarian-observed and research-derived evidence.*

This approach is being increasingly recognised as crucial for the educational activities related to student information competence (Todd, 2001; Brice & Carlson, 2004; Eldredge, 2007). Gathering and interpreting data on student learning is important in terms of formative and summative assessment and also allows teacher-librarians to ground the design of Information Literacy activities on the evidence provided by a systematic analysis of student learning outcomes.

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Not only does assessment form the basis for a summative judgement and the generation of marks and grades, but formative assessment helps student understand their way of approaching information problems and test their understandings with and against others: on the basis of teachers' feedback, learners should modify and develop those understandings. From this perspective, assessment represents an integral part of any learning activity (Ramsden, 1992; Laurillard, 2002).

Assessing student learning also means to establish a baseline around which Information Literacy programmes might be built: a systematic measure of student level of knowledge and skills before a programme provides important information on their background and therefore helps to identify contents and methods that suit in that particular learning context. After the activity, assessment helps to verify if a particular approach was successful and adequate, contributing in a decisive way to the evaluation of the programme, the teachers, the methods adopted, and the assessment method itself (Sheridan, 1990; Pausch & Pagliero Popp, 1997; Kraft, 2002).

Data generated by assessment programmes, once interpreted, need to be communicated to academic teachers and decision makers, which is important with regard to accountability (Iannuzzi, 1999; Knight, 2002). Accountability in fact requires more than demonstrating that Information Literacy is being addressed in undergraduate curricula. Stating that learning activities have been organised or that students have been provided with online tutorials is not enough. Measures of programme effectiveness and students' progress are also required. Librarians in charge of teaching activities should be ready to answer questions such as: What have students learned? How well have they learned?

The data derived from the assessment activity should also be communicated within professional community, in order that they become a shared resource for reflection and improvement (Webber & Johnston, 2000; Taras, 2002; Warner, 2003).

Background

The University of Parma (Italy) is organised in 12 Faculties and 42 Departments, with a teaching staff of about 1,000 people and a technical staff of approximately 900 people. The University offers more than 102 degree and post degree courses, 23 master courses and 47 PhD for about 30,000 students. The University Library System consist of 6 Faculty libraries and 20 Department libraries, which altogether provide access to a stock of about 1 million books, 6,000 printed journals and to a high number of digital resources.

Since 1999 the Environmental Sciences Department has organised an information skills learning programme named "From the library to the Net", which was included, starting from 2001, into the official curriculum and attributed two credits (ECTS). The programme, lasting 15 hours, included five class activities (3 hours each) and involved groups of 20-25 second year students. The learning contents were related to the use of online library catalogues, bibliographic electronic databases, e-journals, Internet and the Web, citation rules. The class activities always took place in the IT laboratory and included frontal lectures, class discussion and practical activities. Students were administrated a final test, requiring to locate some documents using the catalogues and databases presented during the activity. However, this test was not systematically assessed, nor students were provided with a structured feedback. Students' opinion about the learning experience was gathered through a simple questionnaire related to organisational issues and to students' perception of their own improvement in knowledge and skills.

This programme showed some limits related both to the design and the assessment:

- students were provided with only one Information Literacy activity, during their second year of study, with no learning opportunity in two crucial moments of their study life, that is when they enter University and in the third year, when they usually start the literature review needed for the final dissertation;
- the lack of performance-based assessment tools did not allow librarians to measure the outcomes of student learning and to evaluate the effectiveness of the activities. No data were therefore available for a cross comparison over years and with similar experiences.

A different approach was required, which took into account both the need to provide students with learning opportunities during the whole course of study and the necessity of valuable assessment tools integrated with the learning plan.

Aims and objectives

A three-years project integrating Information Literacy activities and longitudinal assessment started in 2004, with the following aims:

- § to provide Environmental Sciences students with a three-year Information Literacy programme addressing their learning needs at different stages of their study and favouring the development of competence, awareness and a critical approach to information,
- § to connect the Information Literacy programme with a parallel longitudinal assessment plan, including the collection of valid and comparable data on student learning and the provision of an ongoing structured feedback.

In particular, the longitudinal assessment plan had these objectives:

From the formative point of view:

- to encourage students to critically reflect on their approach to information in different stages of their University life,
- to provide students with different opportunities to appraise their own progress towards information competence.

From the summative point of view:

- to verify students' starting level of knowledge and skills when entering University (1. year),
- to measure students' improvement after a 15-hours Information Literacy workshop (2. year),
- to evaluate the impact of the whole programme on students' final dissertation (3. year).

Methodology

The Information Literacy programme and the contextual longitudinal assessment were designed in cooperation by the teaching librarian and two academic teachers from the Environmental Science Department. The integration of Information Literacy activities into subject teaching is recommended in LIS literature, as it supports students' motivation and helps them perceive information competence as meaningful. According to many authors (Orr, 2001; Bruce, 2001; Bowden & DiBenedetto, 2001) Information Literacy does not have a life of its own, but rather it is a way of thinking and reflecting about aspects of subject matters.

Recent contributions have underlined the need of contextualising Information Literacy activities, taking into account both the different approaches and experiences of students and the disciplinary discourse and epistemology. Heinstrom (2005) investigates the influence of personality and study approach on students' information-seeking behaviour, while Holschuh Simmons (2005) states that recognising the disciplinary epistemological conventions that shape the knowledge is essential for students to become information competent: librarians play therefore an important role as mediators for disciplinary practices between students and faculty members. Elmborg (2006) relates Information Literacy to the concept of critical consciousness and stresses the need of moving from a skills-based conception, toward a broader comprehension of Information Literacy as a "culturally situated phenomenon": IL develops within the context of an understanding of the research concerns in particular disciplines and therefore cannot take place "in a vacuum". Moreover, the involvement of academic teachers in the design of learning activities and in the assessment of student outcomes is a powerful means for promoting Information Literacy (Dennis, 2001; Doskatsch, 2003). Finally, teachers' perspectives on student approach to scientific information is crucial in the assessment stage, as it allows librarians to verify the actual relevance of their contribute to student learning (Elmborg, 2006). Information Literacy activities were therefore inserted in topical moments of student curriculum, following Vygotsky's idea of the "zone of intervention" where librarians act as coaches (Kuhlthau, 1993), supporting students in their arduous and sometimes frustrating approach to information.

The first term of the first year, students start to become acquainted with a new environment and should understand the role of the library and its services as a learning resource: the first-term orientation activity aims therefore at helping them take the most of the opportunities offered by the academic library.

During the second year, two academic courses require students to write a collaborative essay including a list of references: the Information Literacy workshop is offered as an opportunity to practice information retrieval techniques and to experience a research task in a "safe" environment (Conteh-Morgan, 2002) with the cooperation of mates and the support of the teacher-librarian.

The literature review needed for the final dissertation being an individual research work, an individual intervention is offered, in form of a tutorial addressed to each student's specific research question and including individual support until the piece of research is completed.

The longitudinal assessment plan aimed to be a systematic cycle of enquiry and a shared commitment between all the people involved: students themselves, academic teachers and teacher-librarian with the following features:

- Multidimensional assessment, in terms of testing knowledge, skills and attitudes with appropriate tools;
- ongoing assessment, through a continuous, systematic process, planned and carefully designed in relation to all the aspects of the learning process;
- cyclical assessment, requiring a critical reflection on the teacher-librarian's performance and the flexibility to modify plans and methodology according to students' response;
- structured assessment, grounded on replicable and transferable assessment tools, both direct and indirect, qualitative and quantitative, so that a comparison of student performance over time and with control groups is possible.

Each step of the learning programme is therefore grounded on the evidence provided by the outcomes of student learning, assessed and measured through different tools.

First year: pre-survey and library orientation activity

Information Literacy does not suddenly begin at the Higher Education level, but students arrive at University with a range of prior learning and experience. Building the programme on the basis of this existing knowledge-base is crucial for the involvement of students in something they can perceive as interesting and meaningful (Ramsden, 1992). Students entering the Environmental Sciences course in 2004 were submitted a questionnaire (Appendix 1) investigating their perception of the information world, their current use of public and school libraries and their expectations towards the University information resources.

The questionnaire was submitted in the first week of the first term and consisted of 12 questions (both multiple-answers and open ended). Students' answers were immediately coded and analysed and a portfolio was started for each student, according to the following categories:

- Library current use,
- information tools adopted,
- expectations.

The findings from the questionnaire also served to identify the learning needs of this particular group of students and formed the basis upon which the first Information Literacy activity was built. The orientation activity, organised according to what emerged from the questionnaire (see the "findings" paragraph) consisted of a library tour and a brief presentation of the library services.

Two weeks after the submission of the questionnaire, students were invited to participate in the activity as a group and were accompanied by a teacher. During the previous weeks they had met all the subject teachers and had received reading lists and course outlines. The library was therefore presented as a resource for learning, offering the availability of textbooks, learning materials, tools and facilities. The online library catalogue, the loan and interlibrary loan services, the printed and digitised resources were illustrated in an integrated way and with continuous references to the whole curriculum and the individual courses tasks, so that students could start perceiving the library as an important learning opportunity.

Second year: Information Literacy workshop and related assessment tools

In the second term of the second year students attended a 15 hours Information Literacy workshop. This represented a compulsory curricular activity and students were expected to participate in order to get one credit: the workshop was offered in the second year just when students are asked to present two written essays related to the Ecology course and need to do a small literature review.

The workshop was organised in co-operation with the Ecology teacher and was inserted into the Ecology class. Students were divided into small groups (five-six people each) and were proposed five "information problems" related to environmental topics addressed during the Ecology course. Each group had to prepare and present to the class a list of valuable information resources useful to analyse the problem assigned. Students were invited to avoid limiting themselves to the use of Web resources, but instead to select also books, journal articles and conference proceedings. They also had to annotate their list, justifying their

choice of documents, explaining the research strategy adopted and adding some evaluative comments about the reliability of the information retrieved and its suitability for the analysis of their information problem.

During the class activities (which took place in the Department IT laboratory and in the library) students were presented some scientific information sources (catalogues, databases, Web engines and directories) as well as the most important information retrieval techniques, while the group activity was organised autonomously by the students in the afternoon hours. The final day of the workshop the teams presented their work. A peer-assessment activity, co-ordinated by the teacher/librarian, followed the presentation and represented the “reflective” aspect of the research task. Students were invited to analyse strengths and weaknesses of their own and of their mates’ work, and to identify possible improvements. Appendix 2 provides a more analytical view of the learning activity, including expected learning outcomes, contents and methods.

The second-year assessment tools are a pre/post test and the analysis of students’ research tasks.

The *pre/post test* was administrated to students before and after the workshop. It consisted of 13 multiple-answers questions and 3 open ended questions related to the contents of the learning activity: OPACs, Scientific Journals, Databases, the Web, citation rules (Appendix 3).

The pre/post test was adopted as it offers the opportunity to code and analyse students’ responses and therefore to measure their performance in terms of “scores”, identifying the level and the areas of improvement (Iannuzzi, 1999; D’Angelo, 2001; Palmer & Tucker, 2004). A well-known Canadian model, also adopted by the Monash University in Australia (Bernath & Jenkin, 2006) was adopted as a basis on which a new test was built, adapted and tailored to this particular learning context.

The pre/post test results were recorded and analysed using SPSS version 13.0. For each student the mean of correct answers was calculated and compared before and after the workshop. Each question was then analysed in terms of correct results before and after the workshop with the aim of identifying the critical issues in students learning. The questions with less than 36 % of correct responses were considered worth being given particular attention, as they represented a “failure” in students’ learning (Bernath & Jenkin, 2006).

The *analysis of the group research task* was conducted following a rubric (Appendix 4) taking into account:

- Information tools adopted,
- information retrieval techniques adopted,
- currency, reliability and suitability of documents selected in relation to the information problem,
- citation,
- presentation,
- self-assessment.

The adoption of a rubric was considered important in order to formulate standards and define benchmarks for level of accomplishment (Emmons & Martin, 2002; Allen & Tarner, 2006). A grid was prepared, with performance criteria listed in the rows and the cells across the

columns describing four different levels of performance. Scores from 1 to 4 for each aspect were attributed by the teacher-librarian and the Ecology teacher to the lists of resources presented by the teams. A double-blind method was adopted, with teacher-librarian and Ecology teacher scoring independently students' tasks and then comparing their assessment.

Third year: Individual tutorial, citation analysis and individual in-depth interview.

During the third year of their degree course, Environmental Sciences students start their dissertation which usually requires a broad literature review. Most students participating in the project asked librarians for individual assistance and were offered a two-hours tutorial focussing on the subject of their dissertation.

This individual session was not pre-defined in terms of contents and activities, just because it should be the most possible customised to individual needs. However, students usually asked assistance with regards to the identification of suitable keywords, the use of database thesauri, the use of a reference manager software and citation problems. Another important topic inserted in 2006/2007, following a specific request from academic teachers, was related to plagiarism and the need to correctly quote and cite.

During this project, the individual tutorial was considered also an opportunity for unstructured observation: students' questions and doubts started to be recorded in a grid, in order to identify the critical points in information skills and to put in evidence the topics that were not treated in an adequate way during the second year workshop.

While this contribution is being written, the first group of dissertations elaborated by students participating in this project (the 2004 income, graduating in 2007/2008) are being delivered to the Department library. Students are individually interviewed a few weeks after the delivering, before the dissertation is discussed. In the meanwhile, a citation analysis of the references listed in the dissertation is being carried out. The interview is a semi-structured one; students are asked questions on:

- What was easy and what was difficult in performing their literature search for the dissertation?
- What would they do differently, following their experience?
- Which of the IL activities offered in the past three years were the most useful and why?
- What would they like to be done differently?

The citation analysis is both quantitative (number of citations of books, journal papers, conference proceedings, websites) and qualitative (a rubric considering relevance, currency and correct citation is adopted).

Table 1 summarises the parallel development of Information Literacy activities and assessment methods.

Preliminary findings

The multi-year Information Literacy programme started in October 2004, therefore the first income of students are graduating in October /November 2007. At the moment the complete pool of findings from the longitudinal assessment is not available yet, since only a small number of students (six) have delivered their dissertation to the Department library and only three have been interviewed when this contribution is being written.

Some preliminary results are therefore illustrated, although the analysis is limited to the assessment tools adopted in the first two years of the project. However, some visible changes in terms of knowledge and skills and a development towards independence and critical awareness are rather evident.

Table 1. Information Literacy Programme and longitudinal assessment plan.

Year	Activity	Assessment
1. Year	Orientation activity	Pre-survey: entrance questionnaire
2. Year	Workshop	Pre test Post test Task analysis
3. Year	Individual tutorial	Dissertation citation analysis Individual interview

Even if presenting and discussing incomplete findings can appear a controversial choice, as incorrect from a methodological point of view, the sharing of this experience is considered useful, particularly in the context of an annual conference gathering researchers, students and professionals: comments and suggestions are likely to help the researcher to amend and improve her work before the enquiry cycle is completed.

First year: The Net generation and the library

From the questionnaire administered in the first year this group of students appears as a typical example of the so-called Net generation (Tapscott, 1998) or Google generation: their main, and often unique source of information is Google (D'Esposito & Gardner, 1999, Conteh-Morgan, 2002; Gatten, 2004). A great deal of importance as information source is also attributed to mates and friends.

Question 1 (*Do you have any library card? Specify if it is from a local library or a school library*) showed that most students had applied for a library card; however, all of them answered to question 8 (*What is your main source when you need some information for your everyday questions? Open-ended question*) chose Google or mates/friends.

Moreover, even if many students (19 on 28) stated that they usually adopted the library online catalogue to locate documents (*Question 4 – Which tool do you use when you need to locate a book in one of the libraries of the Parma Library System*), only 7 were actually able to access and use the same online catalogue when asked to try it during the library orientation tour. This provides evidence of something widely stated in the literature about the difference between self-perceived competence and actual competence (Ashcroft, 2006).

As regards the expectations towards the academic library and the University information resources, most students expressed their need for many places to study, many seats, the availability of a high number of textbooks, extended opening hours, the possibility to access the Internet without any form of limitation or control, printing/photocopying facilities.

Nobody expressed the idea of information skills and most students answered to question 9 (*Who usually helps you when you need to do a piece of research at school?*) choosing, among the possible answers, teachers, other students, or the Internet. Only three students put librarians among the useful sources of help for information problems.

Second year: Knowledge, skills, and a different perception

The results of the pre/post test were analysed both in terms of improvement of each student and with regard to the single questions addressed.

From the comparison of pre-test and post-test scores, all students appeared having decisively improved their knowledge about information research tools. As a group, they passed from 46 % of correct answers to 83 % after the workshop. A low number of students showed a remarkable improvement (8 % improved in more than 12 questions over 16) but all students improved at least in 8 questions.

In question 1 – related to the location of a book - students appeared informed about the use of the online library catalogue just before the starting of the activity (85 %), which is likely to be attributed to the orientation activity in the first year. All of them gave the right answer after the workshop.

Before the workshop many students found it difficult to answer question 3, related to the location of journal papers through the online library catalogue and only 29 % were able to identify the correct answer. Also question 5, about the citation of a book section, appeared difficult to students before the activity.

Most questions showed a visible improvement in student information retrieval skills after the workshop, in particular in questions 3 and 6 (related to electronic journals), and in question 9 (about bibliographic databases), which is probably due to the particular emphasis put on these aspects by the teacher-librarian, after students' poor performance in the pre-test: actually, they started to approach electronic journals and databases for the first time just during the workshop.

The development of students' competence appeared evident also from the analysis of the team tasks: apart from one group, all the teams offered quite a good performance. Team 2 and 3 demonstrated to have reached a good level in the use of information search tools and in the management of the research process. They also offered valuable presentations and demonstrated a critical attitude towards their performance, identifying possible improvements, also in the light of other students' work.

Team 1 and 5 did not adopt advanced search features during their research process, but managed to retrieve valuable documents, mainly thanks to a browsing strategy, while team number 4 did not present a good list of resources (also because the team had to deal with extenuating circumstances). However, they appeared aware of the weaknesses of their work and showed a high level of self-criticisms and a disposition to learn from their mistakes.

The results of the group task assessment are summarised in Table 2.

Table 2. Group task assessment results.

Performance indicators	Team 1	Team 2	Team 3	Team 4	Team 5
Information tools adopted	3	4	4	1	3
Reliability and suitability of selected documents	3	4	3	2	3
IR techniques adopted	3	3	3	1	2
Citation	2	3	3	1	2
Presentation	3	4	4	2	3
Self-assessment	4	4	3	3	3
Total scores	18/24	22/24	20/24	10/24	16/24

Provisional discussion

Considering the development of students' knowledge and skills and their changing attitude towards information, it is possible to state that most of them have improved the level of their Information Literacy, even if this statement is limited by the lack of the third year assessment results. Can such improvement be attributed to the provision of the new Information Literacy multi-year programme? Somebody says that educational research is a paradox in that nobody can be sure that any development has been determined by one particular educational intervention, since many other factors can contribute to student attainment of expected learning outcomes (McNiff, 1988).

However, some of the assessment tools adopted in this project can support the hypothesis that the learning activity had a positive impact on student development. As an example, the ability to locate journal papers through the online library catalogue, or to correctly interpret different types of citations, the awareness of the existence of citing rules and their correct application are to be attributed to the workshop with a certain degree of confidence: the comparison between students' performance before and after the workshop allows to state that they actually learned something new, thanks to the learning activity.

Still, Information Literacy is not limited to a set of knowledge and skills on the use of information research tools. In fact, one of the most common critique towards assessment methods such as pre/post tests is just that they do not allow to verify if students are really able to perform a search: a multiple-answers questionnaire can verify if students know what Booleans are and how they work, but does not provide evidence on students' ability to use them in a real research context.

This was in fact a reason for the adoption of a multiple assessment method, with different tools, both quantitative and qualitative. The analysis of the group research task was just meant to add some more information on the aspects related to topic exploration, focus formulation, sources selection, access and use, analysis, synthesis, evaluation and presentation (Kuhlthau, 1993). However, the need to organise the research task as a group activity (which was required by the Ecology course) provided data on the group performance, not on the individual performance. This is a serious limit for the interpretation of student change in their approach to information problems.

However, from the group research task emerged that students attending the second year have acquired a certain degree of evaluation skills. All groups demonstrated the ability to identify

current and reliable sources in an information world, that of the environment-related problems, which is overwhelming and with varied levels of contribution quality.

Many students also understood the importance of using updated resources when analysing environmental questions strictly related to national and European legislation (this is the case of a group involved in a research on genetically modified crops). Even if at the end of the workshop they demonstrated their appreciation for both academic and popular resources, when students decided to insert Web sites into their list of reference, they always chose reliable and updated ones. Students also appeared able to relate the different information sources each other and to present their findings in a logical and understandable way. This appears quite different from what is frequently found in the literature (in particular in the United States context) where students' limits often appear related to a lack of evaluation and critical thinking skills.

Along the years, also an increasing awareness of the importance of correct citation is clearly visible. From a complete lack of interest toward this aspect expressed in the first year, most students evolved toward an understanding of the reasons why it is advisable to cite correctly, demonstrating the change in their attitude at the end of the second year workshop and even more during the individual tutorial (third year). Something similar happened with regard to the importance of using advanced information retrieval techniques and the need to become proficient in the use of complex information research tools. The same students who, in the first year, had stated they felt no need of any other information tool, since Google was enough to them, recognised the added value of a thesaurus for a search through PubMed.

Together with such an increasing awareness, students showed a desire to share their newly acquired competence with their mates. Interest and motivation strongly increased along the years, with students reluctant to participate in the first year activity and longing for the individual tutorial in the third year. The cause of that shifting motivation is probably related both to an increasing awareness of the complex world of information and to the evolving perception of the relationship between information competence and study requirements: while in the first year students mainly have to sit written and oral exams, which do not require to perform any research task, when starting to work on their dissertation students are able to verify the importance of information resources and to appreciate the availability of Information Literacy activities. The change is surely due also to several different factors and is not to be attributed to the Information Literacy activity alone. Rather, teachers, elder students (doctoral students in Italy usually act as tutors of students who start their dissertation) play an important role in the change of attitude towards information.

In the few individual interviews performed up to now, students expressed a real sense of satisfaction when they were given their "portfolio" completed with all the assessments. They appreciated very much the possibility to trace back their progress on the basis of structured assessment tools and expressed their pleasure to have their efforts recognised. The peer assessment was very much appreciated as well. It was considered one of the most fruitful moments of the whole Information Literacy programme: two students stated that while assessing other groups' work, they better understood strength and weaknesses of their own one.

One positive outcome of this project is the cooperation with the subject teachers, which appeared crucial just in the assessment phase: it represented both a way to check the validity of the assessment tools from a different perspective and put in evidence some aspects of the

learning activity and of students' attitude that would have not been noticed by the teacher-librarian.

Some limits of this project are visible, even if the enquiry cycle has not been completed yet. The number of student for each income is very small and is likely to become smaller in the next few years, which limit the possibility to generalise the results. Another problem is related to the identification of adequate control groups, since teachers, curriculum and learning activities are rather different in other courses of the same subject field (as Biotechnology or Biology).

In terms of sustainability, the amount of time and resources needed for this Information Literacy programme and longitudinal assessment plan represents a real worry. The three-years project has started again in the following years, with 24 students enrolled in 2005, 21 in 2006 and another income starting in the first term of 2007, which is very difficult to deal with, considering that different activities are to be organised and data are to be collected in the same time from different groups of students. Since this project is grounded on the principle that learning activities are to be organised according to what emerges from the assessment tools and considering that each income of students is quite different from the previous groups, the amount of work to do is very huge each year.

Tentative conclusions

Assessment appears a crucial part of the learning experience both from the side of students and from the side of the teacher-librarian. By using and comparing different assessment tools and by tracing the development of each student towards Information Literacy it is possible to better understand students themselves and to make learning activities more adequate and more meaningful to them.

Assessment tools that tend to be objective are more likely to be replicable and to provide comparable data (this is the case of pre/post test). However, they are not flexible enough for representing an important part of student learning and are not easily adapted to different groups of students. More qualitative assessment methods, such as task analysis, peer assessment and interviews, better explain students' development but need to be structured in order to be transferable in different situations. A combination of different assessment tools provides quite a rich picture of a learning experience.

This work is a longitudinal study, with the same students followed during a whole study curriculum. This requires a huge amount of time and provides the complete pool of data only at the end of the complete cycle. Even if some limits of this work are evident, the communication of Information Literacy experiences, with particular regard to learning assessment can contribute to the organisation of Information Literacy activities tailored on students' learning needs.

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Appendix 1: First Year Questionnaire

- 1) Do you have any library card?
Yes Specify if it is from a local library or a school library _____
No (If your answer is "no" go to question 6)
- 2) Which library do you usually use?
School library Public Library Other _____
- 3) How frequently do you usually go to the library?
1-5 times a week 1-5 times a month 1-5 times a year
- 4) Which tool do you use when you need to locate a book in one of the libraries of the Parma library system?
Web engine (Google – Yahoo etc.) Online library catalogue
Virgilio (Italian Web Engine) Comune di Parma Portal Other _____
- 5) Which library services do you use (more than one answer possible)?
Place to study Book loan Read magazines and newspapers
CD/DVD loan Use of PC/Internet Do research for school
Do searches for my personal interests Ask librarians for help
Other _____
- 6) Why aren't you using any library? *Open ended question*
- 7) What is your main source when you need some information for study purpose?
Open ended question
- 8) What is your main source when you need some information for your everyday-questions?
Open ended question
- 9) Who usually helps you when you need to do a piece of research at school?
Open ended question
- 10) Which are your expectations towards the University library?
(put in order: 1: most important.....)
 - Extended opening hours
 - Many books, journals, CD ROM etc.
 - Many PC at students' disposal

- Borrowing service
- Availability of all the learning materials listed into the reading lists
- Availability of online information resources: E-journals, e-books, databases etc.
- Facilities: printing, photocopying
- Other _____

11) Which role should the University library play in your life as student?

(put in order: 1: most important.....)

- The library should provide all the textbooks I will need to study for my exams.
- The library should offer me a quiet place where to study.
- The library should give me access to scientific information sources: journals, conference proceedings, databases....
- The library should help me become autonomous in finding the information I need.
- The library should encourage and support me in studying and learning.
- Other _____

12) Add any observations and/or suggestions _____

Appendix 2: Workshop Outline

University of Parma Environmental Sciences Degree Course Information Literacy Workshop

The Information Literacy Workshop has the goal of supporting students in the acquisition of the information competence needed for their study and in their future professional life.

Information literacy is related to the ability to identify an information need, to formulate it, to choose suitable information sources, to access and use information, to critically evaluate it, to synthesise information and to communicate it to other people. Becoming information competent means acquiring self-directed and lifelong learning skills.

The Workshop is part of the Environmental Sciences official curriculum.

The teacher in charge of the Workshop is Dr. Monica Vezzosi

....

The class activity will take place in the IT laboratory.

The class activity is from 9 a.m to 1 p.m.

Students are required to attend at least 15 hours of lessons and to sit a final examination

This learning activity attributes two credits.

1. Learning outcomes

- 1) To become independent and competent in the information seeking and research process, being able to:
 - Identify an information need.
 - Articulate and express it.
 - Choose the most suitable information sources and the tools available to access them.
 - Use effectively some information tools (OPAC, Databases, Search engines and directories) .

- Synthesise the search results .
 - Effectively communicate research findings
- 2) To improve critical thinking skills and develop a reflective attitude, becoming able to
- Analyse and assess in a critical way the outcomes of a research task.
 - Recognise and experiment different ways of working demonstrating flexibility and open-mindedness.
 - Identify strengths and weaknesses of one's own working behaviour.
 - Evaluate one's own learning process.
- 3) To improve students' ability of working in group, becoming able to
- Analyse an information problem in co-operation with other people.
 - Plan together search activities.
 - Define roles and strategies.
 - Manage time.
 - Understand and appreciate different approaches to problems.
 - Synthesise different opinions.
 - Manage conflicts and negotiate solutions.

2. Contents

The world of information

The research process

Sources of scientific information

Information tools: on-line library catalogues
 Full text databases
 Bibliographic databases
 the Web. Engines and directories

3. Group activity

Students will group themselves in teams of five/six people. Each team will choose one topic among those proposed by the Ecology teacher and will use knowledge and skills acquired during the class activities to carry out a piece of research. At the end of the activity students will present their work which must consist of:

1) One list (15-25 items) of information sources related to the chosen topic

This list has to be critically annotated, reporting
 Characteristics of information sources
 Information about availability and access methods
 Critical evaluation

2) One report on the research process and on the team work

In order to prepare this report students will write a group research journal annotating
 Phases of the work
 Choices made and related motivation
 Problems emerged and ways of dealing with them
 A self-evaluation of their own work: (strengths, weaknesses, what could be done differently)

Appendix 3: Pre Post Test

Q1 – You are trying to locate the book “Ecologia applicata ” by G. Marchetti. In order to verify its availability in one of the city libraries you will search

- a) Google
- b) the Parma Library System On-line Catalogue
- c) the University of Parma Web Pages

- d) the card catalogue inside the Department Library
- e) other (please, specify) _____
- f) Don't know

Q2 – You are starting a piece of research on “contaminated landfill sites” and you have no bibliographic reference at all. If you want to find **journal papers** about this topic you will search in:

- a) the www.amazon.com Web site
- b) the University library catalogue
- c) Google or Yahoo
- d) a specialised bibliographic database
- e) Other (please, specify) _____
- f) Don't know

Q3 – Your tutor told you that you should read an article published in the September/October 2006 issue of “Soil and sediment contamination”. The article was written by Mary O'Reilly and Ronald Brink and the title is “Initial risk-based screening of potential brownfield development sites”. To check the **availability of this article in your library**, you search the **online catalogue**, writing:

- a) “Initial risk-based screening of potential brownfield development sites” in the Title field
- b) O'Reilly, Mary AND Brink, Ronald in the Author field
- c) “Soil and sediment contamination” in the Title field
- d) Answers a, b, c are correct
- e) Other (please, specify) _____
- f) Don't know

Q4 – In order to become **fairly familiar** with a subject you know very little or nothing, first you consult:

- a) conference proceedings
- b) an encyclopaedia
- c) a specialised database
- d) a journal paper
- e) Other (please, specify) _____
- f) Don't know

Q5 – You have to identify the following citation:

Grucker, D. (1992) Proton imaging after dynamic polarization
In: Blumich, B., Kuhn, W. (Ed.), Magnetic resonance microscopy. Weinheim [etc.], VCH.

Is the citation above referring to:

- a journal paper
- a book
- a chapter or section in one book

Q6 – Which one of the following refers to a **journal paper**?

- a) MeisterPRO 2004. Crop Protection Handbook. Willoughby, OH:Meister Publishing Co.
- b) Foster W, Chan S, Platt L, Hughes C. Detection of endocrine disrupting chemicals in samples of second trimester human amniotic fluid. J Clin Endocrinol Metab. 2000;85:2954–2957.
- c) CDC 2001. National Report on Human Exposure to Environmental Chemicals. Atlanta, GA:Centers for Disease Control and Prevention
- d) de Voogt P, Brinkman UA. 1989. Production, properties and usage of polychlorinated biphenyls. In: Halogenated Biphenyls, Terphenyls, Naphthalenes, Dibenzodioxins,

and Related Products (Kimbrough RD, Jensen AA, eds). Amsterdam:Elsevier/North-Holland Biomedical Press, 3-46.

- e) IRIS (Integrated Risk Information System) 1996. Polychlorinated Biphenyls (PCBs) (CASRN 1336-36-3). Available:
http://cfpub.epa.gov/iris/quickview.cfm?substance_nmbr=0294 [accessed 21 November 2005].

- f) Don't know

Q7 – You have an **incomplete citation** of a paper (you know the author's name and the title of the paper, but you don't know the journal's name and publication year). You search

- a) the PubMed Citation matcher
b) the on-line Parma Library System catalogue
c) the list of the electronic journals at the University of Parma
d) the Web page of the journal and then browse all the issues
e) Other (please, specify) _____
f) Don't know

Q8 – You have found a book which is right on your topic. Which section of the book will you consult to find **other documents** on the topic?

- a) the glossary
b) The index
c) The table of contents
d) The bibliography
e) Other (please, specify) _____
f) Don't know

Q9 – When searching a specialized bibliographic database for documents on your subject, it is recommended to use the **terminology specific to the database**.

To identify these terms you would consult:

- a) a dictionary
b) a thesaurus
c) an Internet search engine
d) a summary
e) Other (please, specify) _____
f) Don't know

Q10 – To find all the documents **about** Albert Einstein in the library catalogue you would search

- a) By title
b) By author
c) By subject / classification
d) By keyword
e) Other (please, specify) _____
f) Don't know

Q11 – To find the **most recent information** about contaminated sites you consult

- a) a book
b) a journal
c) an encyclopaedia
d) a dictionary
e) Other (please, specify) _____
f) Don't know

Q12 – You have to write a paper on the phytoremediation of arsenic contaminated land

Which search strategy will find the **smallest number and more precise** documents?

- a) Arsenic AND phytoremediation AND "contaminated AND land"

- b) Arsenic OR phytoremediation OR “contaminated land”
- c) Arsenic AND phytoremediation AND “contaminated land”
- d) Phytoremediation
- e) Other (please, specify) _____
- f) Don't know

Q13 – To replace the end of a word when you want to search for **all possible endings** of a given root. (e.g. environment, environments, environmental) you use

- a) The asterisk *
- b) The question mark ?
- c) The dollar sign \$
- d) Other (please specify) _____
- e) Don't know

Open-ended questions

Q14 – What is the Impact Factor (IF)?

Q15 – What does “Peer reviewed journal” mean?

Q16 – What is it needed for correctly citing a Web page in a bibliography?

Appendix 4: Task analysis. Rubric

	4/Excellent	3/Adequate	2/Limited	1/Poor
Information tools adopted	More than three tools adopted	Use of three tools	Use of two tools	Use of one tool
Suitability of documents	All documents related to topic	Most documents related to topic	Some documents relates to topic	Documents un-related to topic
IR techniques adopted	Use of advanced search features	Use of advanced, simple search and browsing	Use of simple search and browsing	Either simple search or browsing
Citation	All documents correctly cited	Most documents correctly cited	Some documents correctly cited	Incorrect citation
Presentation	Methodology presented, choices justified, time respected	Just two of these	Just one of these	None of these
Self-assessment	Identify - strengths weaknesses, possible improvement	Just two of these	Just one of these	None of these